

CLAIMS

1. A planar light source device comprising:
 - a housing having an opening portion on a top face and
5 having a hollow space; - a scattering plate provided at the opening portion; - a reflecting plate provided at the bottom portion of the hollow space of the housing; - a plurality of point light sources arranged in series along at
10 least one side of the housing; and - a refractive element, arranged in parallel with the plurality of point light sources and between the plurality of point light sources and the hollow space, that refracts irradiating light from the plurality of point light sources, and the refractive element refracts light with an
15 incident angle at which luminance is the maximum among light distribution of irradiating light against an irradiated planes of the refractive element, to a bottom face side of the housing.
2. The planar light source device according to Claim 1,
20 further comprising:
 - a housing having an opening portion on a top face and having a hollow space; - a scattering plate provided at the opening portion; - a reflecting plate provided at the bottom portion of the
25 hollow space of the housing; - a plurality of point light sources arranged in series along at least one side of the housing;

a reflector surrounding the plurality of point light sources excluding the side to the hollow space; and

a second reflector provided at a gap between the top face of the reflector and the top face of the housing; wherein:

5 an edge of the reflector exists extendedly inside of an effective display zone to the hollow space.

3. The planar light source device according to Claim 1, wherein an irradiated plane of the refractive element is slanted to the hollow space from the bottom face of the housing to the top face of the housing.

4. The planar light source device according to Claim 1, wherein:

15 a refractive index of the refractive element is referred to as n ($n > 1$);

a slant angle of irradiated planes of the refractive element is referred to as θ_1 ($0 < \theta_1 \leq 90^\circ$);

a slant angle of radiating planes of the refractive element is referred to as θ_2 ($0 < \theta_2 \leq 90^\circ$);

20 an incident angle at which luminance is the maximum among light distribution of irradiating light for the irradiated plane of the refractive element is referred to as ϕ_i ($-90^\circ < \phi_i < 90^\circ$); and

$\text{Sin}^{-1}(n \times \text{Sin}(180^\circ - \theta_1 - \theta_2 - \text{Sin}^{-1}((1/n) \times \text{Sin}\phi_i))) - (90^\circ - \theta_2) \geq$
25 0° is satisfied.

5. The planar light source device according to Claim 1,

wherein the refractive element has

a bottom face;

an irradiated plane, passing first cristas of the bottom face to the side of point light sources, which is slanted from the first cristas in a prescribed angle against the bottom face at the other side with the
5 bottom face of the housing;

a plurality of nearly parallel planes to the bottom face; and

a plurality of radiating planes,

each of the plurality of radiating planes, passing
10 corresponding cristas of corresponding one among the plurality of nearly parallel plane, which are slanted from the cristas in a prescribed angle against the corresponding one among the plurality of nearly parallel planes.

15 6. The planar light source device according to Claim 1, wherein the refractive element has a means for giving to irradiated light extension in direction of length hand of the refractive element.

7. The planar light source device according to Claim 1,
20 wherein the refractive element has a light scattering means at the bottom face.

8. The planar light source device according to Claim 1, wherein the refractive element has at least one side plane, combining
25 an irradiated plane with a radiating plane, which reflects totally irradiating light from point light sources.

9. The planar light source device according to Claim 1,
wherein the reflecting plate has a first slant portion in which a gap
between the scattering plate and the reflecting plate is increased from
the plurality of point light sources to a facing side planes at the hollow
5 space side.

10. The planar light source device according to Claim 1,
wherein the reflecting plate has a second slant portion in which a gap
between the scattering plate and the reflecting plate is decreased from
10 the plurality of point light sources to a facing side planes at the hollow
space side.

11. The planar light source device according to Claim 1,
wherein the refractive element has a bottom face, combining an
15 irradiated plane facing the plurality of point light sources with a
radiating plane facing the hollow space, which inclines like
approaching the bottom face of the housing while going away from the
irradiated plane.

20 12. A display device comprising:
the planar light source device as recited in Claim 1,
a display arranged on the planar light source device.

13. A planar light source device comprising:
25 a housing having an opening portion on a top face and
having a hollow space;
a scattering plate provided at the opening portion;

a reflecting plate provided at the bottom portion of the hollow space of the housing; and

a plurality of point light sources arranged in series along at least one side plane of the housing,

5 a plane, being vertical to a central axis of the plurality of point light sources, which is slanted to the scattering plate.

14. The planar light source device according to Claim 13, further comprising:

10 a refractive element, arranged in parallel with the plurality of point light sources and between the plurality of point light sources and the hollow space, that refracts irradiating light from the plurality of point light sources, and the refractive element refracts light with an incident angle at which luminance is the maximum among light
15 distribution of irradiating light against an irradiated planes of the refractive element, to a bottom face side of the housing.

15. A display device comprising:

the planar light source device as recited in Claim 13,

20 a display arranged on the planar light source device.

16. A planar light source device comprising:

a housing having an opening portion on a top face and having a hollow space;

25 a scattering plate provided at the opening portion;

a reflecting plate provided at the bottom portion of the hollow space of the housing; and

a plurality of point light sources arranged in series along at least one side plane of the housing;

an angle at which luminance being the maximum among the light distribution of irradiating light from the plurality of point light sources for a central axis of the plurality of point light sources being referred to as ϕ_3 ($-90^\circ \leq \phi_3 \leq 90^\circ$),

an angle forming a plane being vertical to the central axis of the plurality of point light sources and the bottom face of the housing being referred to as δ ,

an equation, that is, $\delta + \phi_3 \geq 90^\circ$ being satisfied, and

the plurality of point light sources provided at the inside of the top face of the housing.

17. The planar light source device according to Claim 16, further comprising:

a refractive element, arranged in parallel with the plurality of point light sources and between the plurality of point light sources and the hollow space, that refracts irradiating light from the plurality of point light sources, and the refractive element refracts light with an incident angle at which luminance is the maximum among light distribution of irradiating light against an irradiated planes of the refractive element, to a bottom face side of the housing.

18. A display device comprising:

the planar light source device as recited in Claim 16,
a display arranged on the planar light source device.